

The Knowledge Bank at The Ohio State University
Ohio Mining Journal

Title: Review of the Westward Extension of the Hocking Valley Coal Field

Creators: [Orton, Edward, 1829-1899](#)

Issue Date: 1-Feb-1889

Citation: Ohio Mining Journal, no. 18 (February 1, 1889), 7-22.

URI: <http://hdl.handle.net/1811/32586>

Appears in Collections: [Ohio Mining Journal: Whole no. 18 \(February 1, 1889\)](#)

Review of the Westward Extension of the Hocking Valley Coal Field.

BY PROF. EDWARD ORTON.

READ AT COLUMBUS, JANUARY 10, 1889.

The development of the Hocking Valley Coal Field began about twenty years ago, when it was first reached by railroad lines. The coal of the valley had been known, it is true, since the first settlement of the country, and a little had been mined for local use and for a canal market during the last few years preceding the period named, but all our most valuable knowledge of it is confined to the time since adequate transportation was made possible.

From the first, the field has approved itself as a great store-house of excellent fuel. Its coal constitutes a well-marked type in the markets of a half dozen States, and it is also an important factor in the supply of the same markets.

I wish, on this occasion, in the first place, to review very briefly, the geology of the field, and in the second place, to characterize with equal brevity, its westward extension through York and Starr townships, the only important section of it which is yet undeveloped, and to which but scant justice has been done in the geological reports of the State.

I. THE GEOLOGY OF THE HOCKING VALLEY FIELD.

We know in a rough way the geology of this important tract. Its general section has been worked out, and the order of all the important elements has been determined. The connections of the field to the eastward and the southward have also been traced, and the continuity of the series from Pennsylvania to Kentucky has been abundantly demonstrated. All this can be claimed, while at the same time it is freely confessed that questions can be asked in regard to every foot of the 700 or more that constitute the column, which no man is wise enough to answer. Our knowledge we owe to the united labors of geologists and practical men. Prominent in the list will be found the names of Newberry and Andrews from the first class, and of Sam'l Baird of the second, but there are many beside that have contributed very important observations.

The Hocking Valley field proper consists of the Lower Coal Measures of this portion of the State, but its natural dependencies to the west and east take in the Conglomerate Coal Measures below and the Lower Barren Measures above as well. In

studying the field, we become acquainted with the elements of these three general divisions. There is nothing in *Ohio* geology that would lead us to separate and maintain as distinct the Conglomerate Coal Measures and the Lower Coal Measures, but these divisions are counted necessary elsewhere, and inasmuch as we can identify them clearly here, we are scarcely at liberty to discard them.

The Maxville limestone may be taken as the base of the Hocking Valley Column, and the Pittsburgh coal as its summit. The interval in round numbers can be counted 700 feet, but the lowest portions of the scale are inconstant, and the addition of 100 feet on short notice occasions no surprise, nor does the disappearance of a like amount.

I will name and characterize, in concise statements, the leading elements of the column.

A few feet above the *Maxville limestone* in the Webb Summit Cut, and also at several other points in the district, a thin coal seam is found. There seems no reason to question that this seam belongs to the horizon of the *Sharon coal*, the lowest workable seam of both the Pennsylvania and Ohio series. Its leading representatives in this State are the Mahoning Valley, the Massillon and the Jackson Shaft coal. There are no facts to show that the seam attains any value in the Hocking Valley field.

At the Webb Summit Cut, already referred to, the coal is overlaid by a conglomerate sandstone, which is, without doubt, the representative of the *Massillon sandstone* of Eastern Ohio, or the second of the three great silicious formations that together compose the conglomerate of old time. This stratum appears in strong force in Jackson county also.

Above the sandstone, and about fifty feet above the coal already named, another thin seam is sometimes found. It is shown on the Mohler farm, section 30, Falls township, where it has been dug in a very small way. It may be counted the *Quaker Town coal* of the Pennsylvania section. The Wellston or Jackson Hill coal of the southern counties is by far the most important development of this horizon in either Ohio or Pennsylvania. It has no known value in the Hocking Valley field.

At fifty feet above the Mohler coal, a series is reached that has proved itself invaluable in establishing the stratigraphical relations of the conglomerate coal measures of the State. I refer to the *Lower Mercer series*. It comprises a coal seam, a limestone, and one, and sometimes two, iron ores, with one or more beds of fire-clay associated. Here, for the first time in our review, we find positively connected and approximately continuous horizons, extending from the classical coal fields of Western Pennsylvania to the Ohio River. It is on the strength of this continuity that we are able to identify the elements that have been already named.

The Lower Mercer coal is of small value in the Hocking Valley field as a source of fuel. It is mined in sundry local banks for neighborhoods far removed from railroads. It sometimes shows a good volume, but when carefully analyzed, the seam is found too impure to warrant mining on the large scale.

Neither has the limestone any considerable economic value. Its thickness, which ranges from one to ten feet, would, in any case, forbid the following of it far into the hills, but aside from this, it is too impure to be used for furnace flux or mortar lime. If occasion demanded, natural cement could, without doubt, be manufactured from it. Two iron ores are, in the Hocking Valley field, associated with the series, viz.: a block ore supported by the limestone, and a block ore underlying the coal, at an interval of fifteen to twenty feet. The latter of these is known as the Union Furnace ore; the upper is the Lower Mercer ore proper. Both have been worked on a considerable scale in years past within the district.

The fire-clay below the coal has good volume, and has been proved to be of excellent quality for some purposes. The building brick, which the Columbus works at Union Furnace are now turning out, and which are received with so great favor in all our city markets, come from this horizon. This element, though a new one, bids fair to add much to the economic value of the Lower Mercer series.

The *Upper Mercer series* duplicates the Lower in its general order. It too comprises a clay, a coal, a limestone and an ore. It lies about thirty feet above the previously named division. Its limestone is very often replaced by flint, the latter acquiring a larger volume than the limestone. The flint of New Lexington belongs here. The coal is nowhere mined in the district, sixteen to eighteen inches being its greatest thickness. The iron ore becomes of great value to the southward, under the names of the *Creola block ore* of Vinton county, and the *Big Red block* of Jackson county and Scioto.

The Upper Mercer clay is worked on a large scale at Haydenville. The seam has good volume and good character, and much can be expected from it in the future.

A few feet above the Upper Mercer limestone, another clay seam occurs, which is quite largely worked at Union Furnace. It may be called the *Tionesta coal* from the want of a better name. It occurs near the horizon of a sporadic coal seam of Western Pennsylvania and Eastern Ohio that is known as the *Tionesta coal*. The so-called slate vein coal of this region may be on the Tionesta horizon.

The *Tionesta sandstone*, the third and last of the great silicious members of the Pottsville conglomerate, belongs next above the last named element. It is a coarse and somewhat massive, uneven

bedded sandstone, carrying no pebbles so far as I have examined it, but is often very heavily charged with coal plants. The roots and trunks of the trees of the old coal-swamps are often shown by very distinct impressions on the surfaces of the sandstone beds. This phase is well seen in the quarries just above the railroad level at New Lexington.

The *Conglomerate Coal Measures* of the Pennsylvania scale are completed with the sandstone last named. The *Lower Coal Measures* begin at this point. I have already stated that there is nothing in our geology that would justify, or least that would necessitate such a division of these coal-producing strata, but the divisions are, after all, easily recognizable here, and the laws of geological nomenclature forbid us to displace the accepted names.

The *Lower Coal Measures* constitute by far the most important portion of the Hocking Valley field. They embrace six coal seams, three limestones, two of which have been worked for furnace flux, four or more iron ore horizons, and several considerable deposits of clay, the whole included in about 200 feet of vertical ascent. The principal elements are the following, which are named in descending order:

17. Upper Freeport or Bayley's Run (No. 7) Coal and Iron Point Ore.
16. Upper Freeport Clay and Limestone and Buchtel Ore.
15. Upper Freeport Sandstone.
14. Lower Freeport Coal—(No. 6a).
13. Lower Freeport Clay and Limestone and Ore.
12. Lower Freeport Sandstone.
11. Middle (or Upper) Kittanning Coal—(No. 6)—Nelsonville Seam.
10. Middle Kittanning Clay and Kidney (Snow Fork) Iron Ore.
9. Kittanning Sandstone or Shale.
8. Lower Kittanning Coal—(No. 5).
7. Kittanning Clay.
6. Ferriferous Limestone Ore.
5. Ferriferous Limestone.
4. Clarion or Limestone Coal.
3. Hecla Sandstone.
2. Putnam Hill Limestone.
1. Brookville Coal (Winters' Coal of McArthur).

The two lower coals are of small account in the Hocking Valley field proper. They make scarcely more than their marks in the series. The five lowermost elements in the scale above given are in fact but feebly developed here, but the value of the series begins with the famous *limestone ore* which overlies the Ferriferous limestone. This is known as the *Baird ore* through most of the Valley. It has been worked extensively in the vicinity of

some of the furnaces. Though the seam is thin, not exceeding eight or ten inches, the quality of the iron made from it is so good that the ore has been followed into the hills by deep benchings at many points.

The *Kittanning clay* by which the ore is directly covered, is a deposit of great value, the utilization of which has scarcely been begun as yet. The clay is plastic, remarkably white, rich in kaolin base and of unusual steadiness in composition. Now that so many new uses are being found for clay, and especially since the application of brick to road-making, the value of a deposit like this is sure to be greatly enhanced.

The remaining elements of the series are the common and familiar beds and strata of the Hocking Valley field, upon which its chief value rests. They constitute, in fact, the very heart of the Lower Coal Measures of the State. They are composed of the Kittanning and the Freeport coals, respectively, with the strata that appertain to and separate the several seams.

The two *Kittanning coals*, *Lower and Upper* (or *Middle*), are the most remarkable coals of the Ohio scale. They travel as companion seams, with essentially unbroken continuity, though with many varying phases of fortune, entirely around the margin of the Ohio coal-field and reach, indeed, far into other States. All researches up to the present time, including the results of scores and hundreds of recent deep drillings in the central portions of the coal field, attest the fact that they, as well as the main seams that have preceded them in the Conglomerate Coal Measures upon which they rest, were *marginal* in their formation, and in no case extend far into the interior of the field. The two seams differ widely in character and volume, the advantages almost always belonging to the upper seam. It is this seam, as everyone knows, that constitutes the Hocking Valley coal field. All the rest are subsidiary and but of secondary importance.

The two *Freeport coals* are also widely-extended seams, but they lack the continuity of the great system that underlies them. They can be followed with all confidence as *horizons*, though the coal itself is often wanting for long stretches of territory. A new element in the coal measures of the State comes in here for the first, viz: the presence of the buff or brackish-water limestones. The latter are generally earthy and impure and wanting in fossils, except the inconspicuous and almost microscopic forms of *Spirorbis*. They might well be known here as similar sheets are in England, as *Spirorbis limestones*. The Upper Freeport limestone sometimes has purity enough and volume enough to be worked for furnace flux. The chief development of this phase has been at and around Shawnee. The conditions for coal-making were evidently much extended during the Freeport period, and islands of vegetation extended far into the interior of the ancient gulf. It is

from the Upper Freeport horizon alone that all of the notable occurrences of deep-lying coal far away from the border of the Ohio coal swamp are derived, so far as my opportunities of observation have served to show.

In the Hocking Valley field, no mines are opened in either the Lower Freeport or the Lower Kittanning coals. Both are overshadowed by their better developed companion seams. The Upper Freeport coal in the Sunday Creek Valley attains, as the Bayley's Run coal, its highest excellence. It is of good thickness and good quality, and is steady and uniform in respect to both characters.

THE LOWER BARREN MEASURES.

Above the Lower Coal Measures, a large and well-marked division, but of quite inferior interest in economic value, comes in, viz.: the *Lower Barren Measures* of the general scale. They extend from the Upper Freeport coal to the Pittsburgh coal. No minute description of the composition of this series is required. It consists mainly of sandstones and shales, the Mahoning and the Buffalo sandstones being prominent in the list. Three or four coal seams are found, generally in inconstant development, in the series. But one of them needs to be named here, viz.: the *Brush Creek coal* of Pennsylvania, known in Eastern Ohio as the *strip vein* of Salineville, and the *Groff vein* of Yellow Creek, and worked at both points under the names above given. In the Hocking Valley the seam is too thin to warrant mining, but it is quite steady in its occurrence. It lies intermediate between the Upper Freeport coal and the Cambridge limestone.

The last named stratum, the *Cambridge Limestone*, is an invaluable guide to the stratigraphy of the series in which it occurs. Its place is about 100 feet above the Upper Freeport coal. It is a marine and fossiliferous limestone, sometimes pure enough to be used for furnace flux.

But one other element of the Barren Measures needs to be named. It is a marine limestone of the same general character as that last described. It is widely extended, coming in to our scale from Western Pennsylvania, where it is known as the *Crinoidal limestone*. With us, it is quite commonly designated the *Ames limestone*, this name being given to it by Prof. Andrews before its true equivalence had been determined.

The several divisions and elements that have now been named constitute the striking and salient features of the Hocking Valley scale. The economic value of the field would be reduced but little if all below the Mercer series and all above the Freeport series were stricken off. Its main value, as already stated, consists in the upper of the Kittanning coal seams, the product of which is so honorably known in the markets of all our central Western States as the Hocking Valley coal. In Ohio it is also familiarly

designated as the Nelsonville, Straitsville, Shawnee and Sunday Creek coal.

In regard to the structure of this famous seam, a few words are required. The Middle Kittanning coal comes into the Hocking Valley from a hundred miles of open mines, from Stark county, south-westward through Tuscarawas, Coshocton, Muskingum and northern Perry. While rising and falling in volume and in value to some extent along this long line, it is found at the northern edge of the Hocking Valley field with a well-established character of its own. It is here a twice-parted seam, consisting consequently of three benches of coal. The lower parting is thin, but wonderfully persistent. It stands for a slight depression of the old swamp of continental extent and regularity. The fortune of the lower bench was various. It does not, in some cases, exceed four to six inches, while to the southward, in Muskingum and in Perry, and almost everywhere throughout the field now under consideration, it has twice, three times or four times this measure. In the Hocking Valley it ranges from eighteen to thirty inches. It consists in the main of a block of coal of great excellence. It is somewhat richer burning, and consequently has more coking quality than the higher portions of the seam.

The middle bench ranges from six to eighteen inches in thickness, and it also is almost everywhere coal of exceptionally good quality. It is covered by a very definite and well-known element of the field, viz: the second slate or clay parting. This parting is two to four inches in thickness, and is universal through the Hocking Valley field and far beyond. It stands for a wholesale depression of the coal swamp, more prolonged than that to which the first slate is due.

Above the second slate, the third or upper bench of coal is found. To the north and east of the field now under consideration, this bench does not generally carry a marketable product. In other words, the Middle Kittanning seam is here strictly limited to the two lower benches. Thin layers of slate are interstratified with layers of bright coal and thus reduce the entire bench to *bone* or *cash* or *niggerhead* as it is variously termed in the different sections in which it occurs. Even in the heart of the Hocking Valley field, there is often need for rejecting, on account of inferior quality, the four to eight inches of coal that lie next above the second slate. In other parts of the field, however, no such rejection is necessary. The upper bench of *bone* or *cash* outside the Hocking Valley field is generally twelve to fifteen inches in thickness. Within the charmed circle of the Hocking Valley, it sometimes attains a thickness of two feet.

Thus far we have followed the normal Upper Kittanning coal, finding its three benches all at their best in the region that we are considering, and furnishing five to six feet of clean

coal for the market. But all is not yet told. Above this three-benched seam, still another reinforcement is brought in throughout the Hocking Valley district. It may be known as the Hocking Valley supplementary seam or seams. It is physically strong coal, mining in large blocks, low in sulphur, but high and often excessive in ash. It has been left behind in many extensively worked mines, but it is a cruel necessity, if it be a necessity, that thus robs those who come after us of this noble volume of stored power that all our markets will be eager to take before many years go by. This last addition sometimes reaches a measurement of six feet. When as thick as this, it is always a compound seam.

The full thickness of the main seam is thus seen to be about six feet, to which in the great vein territory, so-called, an equal volume of inferior, but oftentimes still valuable coal, is added. In the Nelsonville district, no account is taken of the supplementary seams, but the operator is happy when he finds the normal three-benched Middle Kittanning coal in perfect condition.

The quality of the seam in its best state can be shown to good advantage from W. B. Brooks's Snake Hollow mines. The coals of the three benches were analyzed separately from carefully averaged samples, with the following results:

1. Lower bench.
2. Middle bench.
3. Upper bench.
4. Average.
5. Average of 10 mines from the field at large.

	1	2	3	4	5
Moisture.....	7.24	6.77	5.83	6.81	5.93
Vol. Comb. Mat.....	34.78	37.31	37.12	36.40	36.48
Fixed Carb.....	56.09	54.18	52.25	54.17	52.41
Ash.....	1.89	1.74	4.80	2.81	5.13
Total.....	100.	100.	100.	100.	100.
Sulphur.....	0.54	0.51	0.50	0.52	1.09

This seems almost too good to be true. The sulphur certainly ranges higher than this in most parts of the field, but the average of the field will not carry it much beyond one per cent. I append the average of ten mines from the field at large. Probably all of our analyses are a little in favor of the coal. The tend-

ency is in that direction, but this, after all, as nearly as it has yet been determined, is the Hocking Valley coal. Where fuel of such character can be mined under the most favorable possible conditions, it is no wonder that the railroads go. To the east of the Hocking Valley the field is quite well occupied already with the main lines and branches of three strong corporations which carried out, last year, a united tonnage of more than 3,000,000 tons, or about $33\frac{1}{3}$ per cent of the total output of Ohio mines.

II. THE WESTWARD EXTENSION OF THE FIELD.

I come in the second place to consider briefly that extension of the Hocking Valley field which lies to the south and west of the Hocking river in Starr township and the eastern half of York township. I do this mainly to correct the statements and supplement the omissions in regard to this district in *Geology of Ohio*, Vol. V. Much new light has been thrown upon it in the interval since that volume was prepared. Along the river valley proper, development has been active on the south side since the railroad was first built. From Haydenville to Nelsonville and beyond, it will be remembered that the valley trends nearly due eastwardly. The Lick Run Mines, the famous Brooks Mines of Section 29, the mines of Johnson Brothers and Patterson, the Steenrod mines are all located on the eastern side of the valley, while beyond, the mines of Hall and Ginity and still below the Glen Ebon, Hamley Run, and Chicago mines have all made full proof of the great seam to the west of the river. Many hundred acres have been worked out by the united operations of the companies above named, and a large production is still in progress. The coal retains the high quality which characterizes the seam elsewhere, as already described, and its volume reaches the normal measure of five to six feet of marketable product except where cut away by intrusive sandstones. In other words the seam was *formed* along the line of these mines in perfect condition and a good bench of the super-numerary seam which represents coal-forming conditions prolonged far beyond the formation of the main seam, is often found in the place in which it belongs, but in parts of the territory, the covering shales and even the upper branch of the main seam have been worn away in channels of considerable extent, by erosive currents, the Lower Freeport sandstone being thus let down directly upon the coal. These reduced areas are perhaps increased in frequency to the southeastward, more waste seeming to be encountered there than higher up the river, but even where they occur enough coal is generally left to constitute a fair basis for mining.

What is the condition of the seam in the territory contiguous to the mining properties already named and beyond to the south and west? The question is an important one for the Hocking

Valley. Considerable development has gone forward on the southern margin of the territory to which I refer, in the important mines of the Raccoon Coal Company during the last five or six years. Local coal banks have also been multiplied to some extent in the same region in the valleys of Raccoon Creek and its tributaries and a better view of the condition of the coal as it here occurs, is thus afforded. The examinations that I have recently made of all of the accessible openings of the seam have, I confess, changed my estimate of this area as a productive coal field to some extent. It now appears to me to give promise of making a large addition of six foot coal to the resources of the Hocking Valley.

I call your attention to the fact that the region in question is well situated *geographically* to make it a valuable addition to the best phases of the Hocking Valley field. It lies to the *southwest* of the thoroughly proved and approved mining territory of northeastern York and contiguous sections of Ward and Trimble townships. The *strike* or lines of level bearing of the strata extend in this southwesterly direction and thus give a sort of warrant for expecting a continuance of the conditions already reported until at least their failure is proved?

Do we find a failure proved as we follow the series to the southwestward? Assuredly we do. The King's Switch and Hope Furnace coal of Brown township, Vinton county, is low coal. The glory of the Hocking Valley seam has certainly departed before we reach the three-foot burrows of this well-worked district. We come nearer to our field than this. The Carbondale mines reach, in their northward extension, Section thirty-one, of York township. We all know what the Carbondale phase of the Middle Kittanning seam is. It has reverted to the type of the seam to the northeast of the Hocking Valley field proper, in which the third or upper bench is no longer wholly marketable. This bench in the Carbondale mines is, in the main, composed of alternating streaks of coal and slate which go by the local name of "nigger-head." But few inches of marketable product are derived from it at best. Here the defect is radical. The top of the seam was never well finished.

What of the Raccoon Company's mines in Sections seven and eight, Starr township, which are the next large workings to the northward? In them the seam shows a marked improvement upon the phase last named. The upper or third bench was originally formed under much more favorable conditions, though still falling short of the Nelsonville type. It contains a good block of marketable coal whenever the shale roof over it is found intact. In part of the workings, this upper bench has been cut away by the Lower Freeport sandstone, which comes down as low as the second or main slate. The two lower benches

have an aggregate thickness of forty inches and the product of the mines has an excellent name in all of the markets which it reaches.

What other testimony as to the question is available? I answer, the important facts furnished by the several openings of the seam that have been worked for neighborhood supply through the southern sections of the two townships. Among these country coal banks are the following:

Oliver Morgan's.....	Section 1, Starr township.
F. M. Simms.....	" 7, " "
W. C. Woodward.....	" 8, " "
J. Collins and others....	" 32, York "

In addition, I may name the shaft which was sunk by George W. Gill, Esq., on what is known as the Eddy and Erwin tract, S. W. quarter Section 26, York township.

On some of these tracts, there are several openings to the coal, some of which exhibit the progress of a change to improved conditions to the northward.

On the Morgan land, Section 1, Starr township, I find that the seam is making decided progress from the Carbondale type toward its better phase. Its structure is as follows:

Shale mixed with streaks of coal	3 feet.
(Bottom part bone coal.)	
Clay parting.....	4 inches.
Upper bench inferior, (but still coal)	2 feet.
Main parting	4 inches.
Middle or main bench.....	2 feet 8 inches.
First slate.....	1 inch.
Lower bench.....	8 inches.
Thickness of coal seam.....	6½ feet.

On the F. M. Simms tract, section 7, Starr township, two openings are found, a comparison of which proves instructive. On the west side of the stream, the seam has the same structure and associations as in the opening named above, except that the overlying shale is reduced to one foot by the descent of the sandstone, and the upper bench is so decidedly inferior in quality that it is doubtful if the markets would accept it, but eighty rods to the eastward the upper portion of the seam only is at present exposed in an abandoned bank. There we find six feet of protecting shale for the roof of the seam, graduating into one foot black slate at the bottom. This overlies nine inches of coal, which in turn is separated from the main seam by six inches of bone coal. The upper bench of the normal seam gives every appearance of being a marketable product, or in other words, the seam has nearly or quite reached the Nelsonville phase in its passage to the east and north.

On the Woodward tract, section 8, the seam is found in very promising condition. It has a total thickness of six feet eight inches, the two lower benches aggregating forty inches, and the upper division having a thickness of two feet ten inches, of

which two feet can be counted coal. The appearance of the upper bench is favorable in all respects, but analysis would probably show a larger percentage of ash than is found in the seam at its best.

Several other openings of the seam remain to be noted, all of them in York township. The well known Collins and Campbell banks, on the north side of section 32, are the most important. Next to these must be counted the Gill shaft above referred to. The shaft was sunk a dozen or more years ago in the bottom of Hewitt's Fork, on the southwest quarter of section 26. The record was made public at the time. The total thickness of the seam was found to be eight feet two inches. It is covered by a heavy body of shale. The shaft has long since fallen in, but in the banks of the stream above the location of the shaft the upper third of the seam is well exposed. It so happens that this is the only portion of it with which we are specially concerned, as it is the only part about which doubt exists. The character of the lower benches can be taken for granted throughout this entire district. All the questions turn on the finishing touches which the seam has received, or in other words, upon the last stages of its history.

The appearance of the uppermost coal at this point is very favorable. The six inch layer of bone reported in the last section as a part of the supplementary seam is here reduced to one inch, and this division now contains thirteen inches of apparently good coal. The character of the third bench, the normal summit of the seam, is freed from all suspicion by the state of things here reported. We can confidently count on this tract as holding coal of the best type of the Lower Hocking Valley; that is of the Nelsonville field.

The Collins and Campbell banks present an equally favorable section. They are located in the valley of the Spring Branch of Hewitt's Fork, and are scarcely more than level free. Mining for the local supply has been carried on for many years here, and several quite extensive openings have been driven under the hills. The structure of the seam is as follows: Bottom coal, ten and one-half inches; Middle, twenty-six inches; Upper bench, thirty-four inches; Black slate, two inches, above which another foot of coal is found.

The black slate makes a perfect roof, as smooth as a ceiling and as firm as a rock, and, therefore, it is not likely to be disturbed in the future working of the coal. So sound a cover is of more value to the mines than the extra foot of coal above would be. A large body of shale makes the cover of the seam through all the exposures in this valley.

The coal of all the three benches is burned with equal approval by consumers. It thus appears that we are still holding in this section the most valuable phase of the Nelsonville seam, which we left behind us in section 26,

What conclusion as to the condition of the coal in the territory to the northward, intervening between the openings here recorded, viz. : the Raccoon mines, the F. M. Simms' north bank, the Woodward coal, the Eddy and Erwin shaft, and the banks last named on one side, and the great mines on the south side of the Hocking Valley on the other, are we warranted in drawing from these several lines of facts? It seems highly probable, in fact, certain, that the best phase of the Hocking Valley seam *originally* extended as far south as sections 25 and 31 of York township, and passed thence through section 1, Starr Township, touching the northeast corner of section 7, and passing thence into section 8. If this is granted, it carries with it by implication this conclusion, viz. : that a valuable body of coal, comparable in all respects with the coal of Lick Run, of Brooks's mines in section 29 and of Johnson Brothers and Patterson mines, holds all this interval, presumably occupying sections 2, 3, and 4 of Starr township, and extending to the eastward as far as the Floodwood field and the other mines of the river hills.

There is no doubt that reductions will be found in the coal at numerous points, originating in intrusive descents of the Lower Freeport sandstone, but against this fate, the seam can nowhere be insured. It is satisfactory, however, to know that though eroding currents may have wasted it, their force was generally spent before the second or main slate was reached, leaving untouched a body of coal that justifies mining on the large scale.

If future tests shall confirm the view that I have now presented, a view that seems to be well supported by all the available facts, it is seen that there are here ten to twelve square miles of unbroken territory, covering coal exceeding five feet in thickness, that await the advent of the civil, and afterward of the mining engineer. The district will make in this case, one of the noblest sections of the great Hocking Valley field. It lies under heavy cover, the hills of Apple Pie Ridge rising to 300 feet and upwards above the valleys. No wants are to be found in the coal that take their rise in the erosion that is now going forward, by which the surface relief of the country has been effected. It lies too low for that and the great coal sheet is spread out just as nature left it when the series was completed. It would be a happy fortune if this entire body of coal could be attacked and worked under some comprehensive plan, based on the best mining experience that has been acquired in the valley thus far. The extreme regularity of the system invites such development. In no coal field of the world has there ever been found a more surprising steadiness in respect to all the geological factors.

The geological section of this region is simple and intelligible. The highest ground catches the Cambridge limestone of the Barren Measures, and in considerable part of the territory all the

valuable elements that lie between the Ferriferous and Cambridge limestones are *due*. The Lower Kittanning coal will quite certainly be found to be a seam of mining thickness in parts of the field, wherever three feet of coal will justify mining. The same thing is true of the Lower Freeport coal. This seam appears to be fairly steady throughout the district under consideration. It is about three feet in thickness in its usual exposures. How much is to be expected from the presence of the Upper Freeport coal in this district it is hardly safe to say. Where it is found in its westernmost outcrops, it has a thickness of four to four and a half feet, but in addition to the high level which it must hold, its general instability forbids us to build upon it, as we can safely build upon the noble seam that derives its most honorable name from the Hocking Valley. The Upper Freeport coal is likely to be best in the eastern sections of territory which we are considering. That valuable deposits of this age belong here, has been amply demonstrated in extensive mines on the west side of the river, in the Glen Ebon mining property. I have not spoken of the subsidiary resources of the tract which I have been describing. Next to the coals, I should make most account of the clays of various grades which it contains. I have no doubt that great industries in clay manufacture, like those already in operation at Haydenville and Union Furnace, will be multiplied in various parts of the district in time to come, and that they will contribute largely to its permanent prosperity.

DISCUSSION OF PROF. ORTON'S PAPER.

Hon Andrew Roy: I think there should be something said about Prof. Orton's paper, as it must be of special interest to the coal men of the Hocking Valley; although I hardly feel in a condition physically to say much myself. However, I want to congratulate Prof. Orton on one statement that he makes, that is in regard to the extension of the lower coals farther into the basin than was formerly supposed. I remember once, when I read a paper here, he took strong grounds against the idea of the possibility of the lower coals extending any distance from the margin of the basin; that they were built up like a series of inverted stairs, and to use his own language, as near as I can quote it, "to look for the lower coal under the Nelsonville coal, or to look for the Nelsonville coal under No. 1, was to look for the living under the dead." I thought he was mistaken at the time, because I felt that I had seen the very evidence that he said was impossible. I wish to congratulate the Professor in coming around. Of course, you all know that Prof. Orton, when he finds that what he has said previously is not correct, is willing to admit he was mistaken before.

There has been some discussion as to how thick coal existed in certain portions of the Hocking Valley, rising to eight, nine and ten feet, while in other portions it was only five and one-half or six feet, and that within a short distance. In one of my reports as Mine Inspector, and on other occasions, I cited the fact that that thick coal was due to the union of two seams. The idea went abroad that I meant that No. 6a and No. 7 joined with the thick coal of No. 6, and one seam was formed. Now, that never was said; and even if it were said, it is not true. I did say that the reason of the great thickness of the coal around Straitsville and below Nelsonville, in the Hocking Valley, was due to the union of two seams, but that the upper seam was a rider, a seam found there that was not found in other parts of the coal field; you find it in the roof of certain mines, separated from the main coal by about eighteen inches or two feet of shale. As you go down in the valley, you find the two seams coalesce or come together, and what was six feet of coal at Nelsonville becomes nine feet at Doanville. As you go up the Valley towards Buchtel, you find shale coming in, but the upper coal is still there. On the other side of the river, in a mine owned by Sheffield Brothers, you can see this rider come down on the coal, and you find the coal to be eight and a half to nine feet thick; while in another room in the same mine you find that it has split up, and only about six feet of coal is there, but up in the roof a foot or two you find the rider again; and then probably it would be but a few hundred yards to where the two coals were together. I have noticed three feet of

shale intervening within a short distance between the two coals in this mine. At Zaleski the same condition exists there in Coal No. 4, so far as the upper bench is concerned. There the coal is mined about four feet to four and one-half in thickness, and the shale parting bears about the same relation to the coal as in the Hocking Valley. In one part of the mine the upper bench separated and gradually raised until it got fourteen feet above the second bench, and upon following it around again, to the other side, it came back and bore the same relation as it did when starting out. These are matters which have come under my observation, and I have had occasion to call your attention to them before; but I seem to have been misunderstood, and hence, I repeat them to-night.

Prof. Orton: I get so few congratulations that I am sorry to dispense with any that come to me, but I hardly think I deserve those that are tendered to me by my friend, Mr. Roy, if he understands me to have changed my view materially in regard to the matter of the marginal coal seams. I think that is one of the most sensible things I ever got hold of, and I hold very firmly to it at the present time. If I remember right, I made, in my paper, the same sort of a qualification I would make now. I would provide for islands in the seams that reach out, but I still hold with increasing confidence to the doctrine of the marginal growth of the seams.